TROPICAL AGRICULTURE

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EMPIRE COTTON.

THE Annual Reports of the Empire Cotton Growing Corporation and the British Cotton Growing Association contain abundant evidence of the progress being made in the efforts to establish this important Empire industry upon a sound basis. Since the War rapid progress has been experienced with the exception of the period 1921-22. In 1918-19 the Empire cotton crop amounted to 82,220 bales,* and by 1924-25 had increased to 356,947 while during the period 1925-26 a total output of 428,133 bales is expected. During the year under review, the Blue Nile Dam at Makwar was opened, representing the culmination of labours continued without respite since 1904, backed throughout by the unflinching support of Lancashire. Eighty thousand acres are already under cotton, a fact which reflects considerable credit upon both the Sudan Government and the Sudan Plantations Syndicate in view of the short period at their disposal. Progress both in the irrigated and rainfall areas has been most satisfactory, and provided the existing high standard of administration is maintained, it is difficult to place any limit upon the possibilities of this area. Sir William Himbury, General Manager of the British Cotton Growing Association visited cotton growing areas in India, Kenya, Uganda, the Sudan and Egypt and reported very favourably upon the progress being made. He was particularly impressed by the possibilities for cotton and other crops which are being opened up as a result of the construction of the Sukkur Barrage and the extension of irrigation in the Punjab and Sutlej Valley Scheme. Other administrative and technical officers of both organisations have visited existing and potential cotton growing countries and their reports contain convincing evidence of the possibilities of Empire cotton.

Another notable event occurred during the year in the establishment of the Empire Cotton Growing Corporation's Central Research Station in Trinidad, which is intended as a reinforcement of, and not a substitute for, the existing research stations which have done and continue to do such good work in solving local problems. Exceptional difficulties have been experienced in different cotton growing countries within the Empire during the past year and the Corporation has continued its policy of strengthening the local Departments of Agriculture, by the appointment of trained scientific officers for dealing with

* Each of 400 lb.

special cotton problems. Each year the Corporation awards a number of post-graduate studentships for the recruitment of such officers. Thirty-one men have so far received training under this scheme, and have been appointed to posts in various cotton growing countries. During the past Session another eight students received training at this institution, and will shortly be posted to various cotton areas, while in the Session 1926-27 another group of students is expected. The Colonial Office has recently decided to offer a number of post-graduate Scholarships in Agriculture tenable at this and other institutions, on similar lines to the Corporation's Studentship scheme. Students under this scheme are expected in residence here during the coming Session and from 1927 onwards it is the intention of the Colonial Office that vacancies in the staffs of the Agricultural Departments shall be filled as far as possible from these men. This will probably relieve the need of the Corporation to undertake the training of men. In addition, the Corporation makes grants annually to certain Universities and institutions in return for which a member of the staff has been detailed to study certain branches of cotton literature and to undertake any specific pieces of research work required.

Another important factor in connection with cotton growing, and one to which the Corporation has given consideration, is the question of transport facilities. Many potential cotton growing areas are prevented from growing this crop solely on account of the absence of adequate means of modern transport, while other areas are seriously retarded for the same reason. The publication of the Report of the East African Commission was generally recognized as constituting a notable contribution towards the solution of the transport problem in this part of the Empire. The Secretary of State for the Colonies has set up a small Committee to consider, among other things, not only main railways, but also the subsidiary lines of communication for which track vehicles might possibly be used for transport purposes in providing feeder routes to the main lines of communication. The Corporation has already conducted experiments with "roadless" vehicles, not only in the United Kingdom, but also in Nigeria, and although the results at present may appear disappointing they at least provide encouragement for the hope that types will eventually be evolved to meet the totally different needs of tropical countries. This problem is an entirely new one and it is satisfactory to note that British manufacturers of commercial motor cars are co-operating with the Corporation in an attempt to evolve suitable types.

The progress recorded in the growth of Empire cotton with its allied problems is most encouraging, but no one realises more fully the immense difficulties to be encountered than the two organisations whose reports are under review. Each year new problems reveal themselves, but with the efficient organisation which is gradually being built up, there is every hope that solutions will eventually be found. There is no longer any reason to fear that the United Kingdom cotton industry will always remain dangerously dependent upon one source of supply for its raw material. The strong support which is now being given by the Lancashire industry in the solution of its own difficulties is an example which might well be emulated by other industries whose source of essential raw material lies within the tropics.

FOODSTUFFS.

Tea Prices Inquiry.

A CORRESPONDENT writing in the *Times Trade and Engineering Supplement*, 10th July, states that "Sir Stanley Bois and Mr. H. K. Rutherford, representing the Ceylon Association in London, and Mr. Gerald Kingsley, representing the Indian Tea Association (London) gave evidence before the Food Council on 2nd July. Their testimony had relation to the producers' side of the tea industry, with special references to the prices obtained in the London market and the prospects before the industry in regard to the output. On the instruction of the Government, the Food Council has for some time been investigating complaints of the high price of tea by the time it reaches the consumer, and with the hearing of the producers' witnesses the taking of evidence has now been finished. It is expected that the Council will furnish its report to the President of the Board of Trade by the end of this month.

The Tea Brokers' Association of London has issued statistics showing that the imports of tea into this port in June were 26,313,129 lb., the total for the corresponding month last year being 22,434,887 lb. Last month deliveries from bond reached 36,026,928 lb. in comparison with 34,470,895 lb. a year ago. The stock of tea in London on 30th June was 141,815,103 lb., this figure being 24,000,000 lb. below the stock at 30th June, 1925. The following entries show the comparative position for the first half of the year :—

	Imports lb.	*Deliveries* lb.
Six months to 30th June, 1926	.. 166,966,197	212,498,705
Six months to 30th June, 1925	.. 187,139,173	208,263,254

In the sugar trade it is thought that the worst period of depression has now been past. The restriction of the Cuban crop has not so far influenced the position from the sellers' point of view. Cuban output to date is 4,900,000 tons, and the crop is now almost completed. The outturn last year was 5,125,970 tons. The present stock in Cuba is 1,339,605 tons, compared with 1,121,345 tons a year ago."

THE RELATION BETWEEN FORESTS AND RAINFALL.

By Col. Sir. Henry G. Lyons, r.e., f.r.s.

The occurrence of dense forest growth in regions of heavy rainfall, and the humid atmosphere and damp soil which prevail in many forest regions suggest a relation between forestation and rainfall which has often been construed to mean that forests cause the quantity of rain falling in their immediate neighbourhood to be larger than that falling on a corresponding area on which no trees are growing.

Proof of this is difficult to obtain and even the records provided by rain-gauges exposed within and without the forested area need care in their interpretation; the trees reduce the velocity of the wind blowing over the forested area and tend to cause the amount collected in the gauges to be larger than on treeless and more wind-swept land. Again, when rain falls on trees a proportion, estimated by some at 25 per cent., is temporarily held on the surfaces of leaves and branches where the drops evaporate more freely than on the ground, thus making comparison more difficult.

The relation of forests to climate, and especially to rainfall, has been investigated on many occasions and in many parts of the world without any satisfactory proof being furnished that they influence materially the rainfall of a district. Even where reliable measurements of rainfall are available, these vary considerably from year to year, and a long series of observations is necessary before they can be expected to furnish reliable evidence of climatic change.

The Government of India carried out an exhaustive enquiry during the ten years from 1906 to 1915 in order to ascertain whether there was evidence of any relation between forests and atmospheric and soil moisture in India. The results were published in Forest Bulletin No. 33 (Calcutta 1916) where it is stated that the influence of forests on rainfall is probably very small, the Director General of Observatories giving as his opinion that probably it did not reach 5 per cent.

In 1910, Dr. W. L. Moore, then Chief of the United States Weather Bureau, published a report on the Influence of Forests on Climate and Floods in which he and Professor Cleveland Abbe record their opinion that forests have little or no effect on the quantity of rain falling. Similar conclusions have been reached by other investigators working other regions.

Let us now consider the meteorological conditions which prevail in and near a forest region. Summer temperature is usually slightly less in the forests, and winter temperature slightly higher than in the open country. Sheltered by the leaves and branches the soil loses less by evaporation than does treeless land, and so conserves the rain that it receives longer. Growing vegetation transfers a large amount of water to the air by transpiration through its surface pores, and from his experiments at Mariabrumn near Vienna, von Höhnel estimated that an acre of oak forest 115 years old contributed to the air in this way about 10 tons of water daily on the average.

In the marsh region of the Upper Nile (Bahr el Jebel), the loss of water through the vegetation and by evaporation from the open water surface of lagoons, over some 600 kilometers of valley, reaches about 220 cubic metres per second at low stage and 600 cubic metres per second in flood. The water vapour in the air immediately over the forest or the valley is thus increased but it is being continually removed by the air currents and no additional precipitation can be traced to this cause.

It is now generally recognised that rain falls continuously when a current of moist air flows into a region where it comes under reduced atmospheric pressure; the expanding air is unable to contain all the water vapour so that a proportion of it is condensed to form clouds and finally rain.

Such conditions occur when a moisture-laden current striking against a hill range is deflected upwards into higher altitudes; or when a colder and heavier air current pushes underneath a warm moist current forcing the latter upwards; or when the heating of a mass of air in contact with the ground gives rise to an ascending current of warm moist air as in the case of hot weather thunder storms. So long as such conditions continue and the supply of moist air is maintained to be carried up to altitudes at which it can no longer retain all its water vapour rain will continue to fall.

But such conditions are not provided by forests. Forests on a hillside may gain by the heavier rainfall on that slope which is the more exposed to moist air currents, and tropical forests flourish in the heavy rainfall provided by the upward movement of masses of moist heated air near the equator, but the forest is not the determining cause of the precipitation.

Forest covered hill-tops standing in a moist air current will often be covered with a cloudcap and the water particles will condense freely on the leaf surfaces of the trees. In this case the forest may cause an appreciable amount of water to be condensed and so become available, as on the Ascension Island, which on a bare hill-top would probably evaporate in the drier air on the leeward side of the hill.

Thus it will be seen that forests alone cannot provide the energy needed to raise a moist air current to such an altitude as will ensure a proportion of its moisture being precipitated as rain. A hill range whether forested or not may do this as also may a colder current with its greater density pushing under the warmer current and raising it; either of the secan and do provide that continuance of suitable conditions which results in a steady rainfall. There is nothing which forests, apart from the mountainous country in which they may occur, possess which can produce like results.

ROAD TRANSPORT IN AFRICA

And a note on the Experiments of the Empire Cotton Growing Corporation in Nigeria.

BY COLONEL C. N. FRENCH.

(*Concluded.*)

5. The Caterpillar or Track System. This alternative to wheels received a great stimulus during the war owing to the development of tanks. Tanks had very high road resistance, but by the time they were invented motor engines had made it possible to develop great motive power to overcome this. Nevertheless, great tractive effort postulates great friction, and friction means destruction, and the life of the original tank tracks was only a few miles, while the road resistance was about 600 or 700 lb. per ton as compared with the 5 lb. per ton of a railway wagon, or the 60 lbs. per ton of a motor lorry on a good hard road. It should be remembered that the road resistance of a wheeled vehicle increases rapidly with the deterioration of the surface, until, on soft grass land or earth loosely ploughed, it will register up to 350 to 400 lb. per ton. But until such surfaces are reached, the wheel is superior to the type of track used on the original tank—that is to say, a rigid track consisting of plates hinged together in such a way that movement is restricted to one plant. A vehicle with such a track can take a curve only by skidding and its capacity for adapting itself to the ordinary irregularities in its path is very limited. Hence the need for high power with consequent increase in cost, weight, and fuel consumption. The disadvantages of the rigid track were not appreciated, nor were adequate efforts made to overcome them until, in 1900, Diplock developed his Pedrail, the underlying principle of which was to allow individual and universal movement in each foot or plate of the track. He was the first clearly to recognise that the ideal track is perfectly flexible and able to adapt itself to all the minor irregularities and unevenesses of its road. There are sometimes conditions in agriculture and forestry where the ground is of so plastic a quality that it will readily conform to the rigid track, where the question of speed does not arise, and where the percentage of power from the engine available at the draw-bar is not of importance. Such conditions provide a limited field of usefulness for a rigid track machine, which, with all its faults, will at least stay on the surface and haul when the driving wheels of a conventional traction engine would be spinning round and digging themselves into the ground. But where cost per ton-mile is the dominating consideration, where comparatively high speeds are desired, and where destruction of the surface traversed cannot be tolerated—in short, where transport, and not agricultural needs, such as ploughing or haulage, is the end in view, then some adaptation, development, or improvement of the flexible track is essential.

The most promising development up to the present has been in the form of "half-track" vehicles, in which the front wheels are retained for steering purposes and the rear wheels are replaced by a flexible double-track system. These two tracks and their bogies carry most of the weight of the vehicle and the load. Of such "half-track" vehicles probably the best known is the Citroen-Kegresse car in which successful journeys have recently been made across Africa.

In this type, to which further reference is made in connection with the trials recently carried out, the track is of a rubber composition, so that the necessary flexibility is obtained without the introduction of joints.

Another promising form of half-track vehicle is that fitted with the Roadless Traction Company's track, which consists of an endless belt of steel plates forged out of the solid and hinged together by means of a special type of ball joint, permitting of universal movement, limited in extent, but sufficient to enable the vehicle to turn on a radius of 15 feet without skidding.

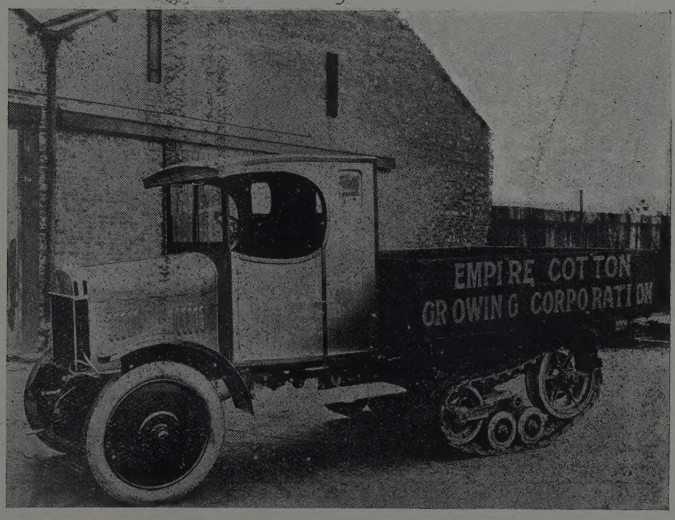
It is perhaps unfortunate that this vehicle should be called "Roadless Traction" because it is not suggested that roadless transport is required in Africa. What is wanted is a vehicle that can travel on an unmetalled road without damaging it.

In both cases the weight of the vehicle is carried on two four-wheeled bogies, one on each side. These bogies run on the inside of the track. The lower portion of the track is in contact with the road, and in consequence of the considerable length of it that rests on the road surface, the pressure per square inch on that surface is very small: *i.e.* from 5 to 20 lb. per square inch, according to the type and size of the vehicle. Trials have proved that such vehicles can negotiate irregularities on the surface and gradients impossible for ordinary wheeled and even for four-wheel-driven vehicles. But the solution of the African transport problem is not to be found in the accomplishment of such spectacular feats; the vehicle that is needed is one that, fully laden and pulling its full complement of trailers, can pass over soft tracks not only without cutting them up, but leaving them better than it found them as far as subsequent vehicles are concerned—one which can do all this without requiring high motive power in order to overcome high road resistance. Such claims are made for "half-track" lorries by the manufacturers both of the Kegresse and of the Roadless Traction tracks, and, trials have shown that both types tend to improve a sandy surface and have a consolidating effect on an earth or grass surface: but their commercial value has still to be proved, because the life of the various types of track has not been adequately and impartially tested, and little is known regarding the cost of maintaining them.

It was for these reasons that the Empire Cotton Growing Corporation decided, in order to test the efficiency or otherwise of the half-track vehicles,

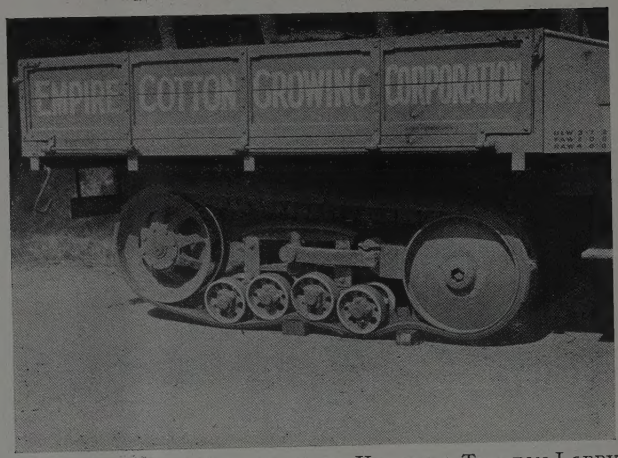
Road Transport in Africa.

MORRIS ROADLESS ONE-TON LORRY PASSING OVER SOFT SAND.
(By permission of Messrs. Morris Commercial Cars, Ltd.)



19·5 H.P. GUY ROADLESS 25-CWT. LORRY.

Road Transport in Africa.



TRACK UNIT OF 25·8 H.P. BURFORD-KEGRESSE TWO-TON LORRY.

THE NEW MORRIS SIX-WHEELER.
(By permission of Morris Commercial Cars, Ltd.)

to purchase and send to Nigeria three of them—namely, a Burford 2-ton lorry fitted with a Kegresse track, a 2½ ton and a 25 cwt. Guy Lorry with a Roadless Traction Company's track with two competent driver mechanics who could give full reliable and unprejudiced reports on the maintenance, comparative efficiency and working costs of the vehicles and particularly of the two types of track. Prior to despatch to Nigeria these lorries were tried for about 1,000 miles over a course which resembled as far as possible an African earth road.

The home trials of the half-track vehicles were on the whole encouraging. The worst obstacles on the course were tree stumps which imposed an unfair strain on the lorries. On the other hand vegetation, such as heather, grass or bracken was found to be an advantage rather than otherwise. The tracks, especially the metal one of the Roadless Traction Company, which was broader than the rubber Kegresse one (during this trial an 8-inch track was used on the Burford, a 10-inch one has been substituted in Nigeria) crushed this type of vegetation down, forcing it to grow tightly and compactly, and to "bond" the unmetalled surface, and there seems little doubt that a comparatively broad track will be a better road maker than a narrow one.

On the other hand the trials of the Burford and the 25 cwt. Guy (the 2½ ton Guy did not arrive in time for the cotton season) in Nigeria have proved somewhat disappointing. In the first instance they were used on the "all season" Zaria-Sokoto road which is faced with laterite gravel, and it was found that this gravel has a most damaging effect on both tracks, while in the case of the metal one it burred the nuts which protected the lubricating nipples and made the greasing of the track joints a tedious and difficult operation. It is clear, therefore, that a road with anything like gravel on top of a hard surface is not suitable for half-track lorries. In addition the careless handling of a native driver resulted in serious damage to the bogie and track of the Guy 25 cwt. lorry, so much so that at the end of the season it was necessary to dismantle the vehicle and send the track and bogie to England for examination by the manufacturers. In their present stage of development half-track vehicles require careful and skilled driving. They are liable to get rather hot and special radiators with a large surface and a big water capacity will probably prove desirable.

Up to the present the Burford-Kegresse 3-tonner has been found more efficient than the Guy-Roadless 25 cwt. lorry. It is expected, however, that the 2½-ton Guy will be more efficient than the smaller one, and indeed that, within reasonable limits, the larger and more powerful a half-track lorry is the more satisfactory it is likely to be. The 8-inch Kegresse rubber track has a very short life (about 2,000 miles) and it will be essential to improve on its design and manufacture if it is to become a commercial and not a "stunting" proposition. When the Burford was used on a genuine earth road it did most excellent work in bringing in seed cotton from a district which has never been satisfactorily tapped by any form of transport in the past. And this in spite of the fact that the road in question was not well graded and that, consequently, it was not possible to use more than one trailer.

It cannot be sufficiently emphasised that, whatever the final results of these trials, much will remain to be learnt about half-track vehicles. Tracks, however efficient, will not in themselves solve the African transport problem or reduce freights so as to make it economically possible to export low priced agricultural products as well as expensive ones, and thus to develop a system of rotation that will benefit the land and may help to fight insect pests. The success or failure of half-track vehicles would seem in the writer's opinion to depend primarily on whether the tracks and bogies can be strengthened and simplified, whether local administrations agree with the view that a purely commercial road is a seasonal one as far as heavy traffic is concerned, and that earth roads can be developed so as to carry slow moving heavy traffic in the dry season and light fast moving traffic throughout the year. If half-track vehicles are to be tested satisfactorily the tests must be carried out on such roads. In any case where wheeled lorries are used (and there is no doubt that they will prove most effective on some roads, especially if some cheaper form of propellant can be developed), their speed should be most severely limited because, at present, it is not financially possible to build roads that will stand the strain of even a limited number of them as driven by the average African uncontrolled by a European.

There is no doubt that there are many systems well worth investigation, wheeled lorries on partially metalled roads and half-track lorries on earth roads are only two of them, and it is to be hoped that others will be developed and explained in further articles by writers who have investigated them.

BAY RUM.

A Circular has recently been issued by the Department of Customs and Excise of Canada, File No. 126788 No. 220-C Supplement B. to Collectors of Customs and Excise to the effect that they advise all licensed Bonded Manufacturers within the limits of their Port, that in respect of the manufacture of Bay Rum and other Lotions, and Colognes, the addition of one of the following denaturants, in the proportions stated, is required, viz.: to each Imperial Gallon (8 lbs. 3 ozs.) when completely manufactured, prior to the addition of water and filtration, there shall be added two ounces Quinine Hydrochloride, B.P., or as an alternative, one per cent. Diethylphthalate and so, in proportion, for any less quantity than a gallon.

ON THE PROFITABLE NATURE OF ALTRUISM.

BY W. LAWRENCE BALLS.

"To learn, one must live, master; and I have lived long enough to learn the grand point of wisdom."
"What is that? said I.
"That honesty is the best policy, master"

—*Lavengro.*

[*This article is written from an industrial outlook and may, in consequence, be considered to be misplaced in an Agricultural Journal. The sentiments and views expressed have, however, a wider bearing than that to which the article is confined. The policy of exclusiveness and secrecy is to be found in the agricultural, as in the industrial, field. That such a policy does not pay in the long run in agriculture as in industry is hardly beyond question. That it is ineffective for more than a limited period is certain. The history of the para rubber industry clearly illustrates that point. To Sir Henry Wickham is due every credit, and that credit is in no way diminished by the statement that if he had not, someone else would have achieved the same end. The time factor is, alone, the doubtful quantity. And, after all, what is a few years in the course of civilisation? Without doubt secrecy in industry or agriculture or research is a policy which does not pay.*] ED.

IT is pleasant to find one's wilder notions regarded so seriously that an editor invites their embodiment in an article. Nevertheless, to write on the disadvantages of secrecy to modern industry is not easy. Considering the matter from the moralist's aspect one merely emits platitudes; yet these same platitudes seem to be wilful paradoxes to the financier. This article would be more convincing for the latter if it described details of the many examples which are available, but such treatment has its inconveniences, and a lighter sketch must suffice.

Man is by instinct egocentric, and in no way resembles a bee. He uses the first half of his life, at least, in learning that the objects familiar to his childhood are not, as he then saw them, immutable and eternal. As a child he lives in a static world; the old oak palings which fence his garden from the adjoining fields are objects of everyday experience, and always will be there. Twenty years later he finds with a shock that the fence has gone; a fixed idea is broken; he has grown up. But many people grow up very slowly.

Communities are quite similar to children. You can drive your car all over Great Britain when at home on leave; you can cross the Welsh Marches or the Scots Dyke, and never notice the frontier which once was there. But it would only take two transmissions by word of mouth within a long-lived family to turn back the calendar into times when Scots and English could not be imagined as other than natural enemies. Even now we have not grown up far enough for "Punch" to weary of the Scotch joke, that last vestige of ancient feud. A century is a very short time in human memory; first-hand stories of the "Boney" invasion scare have been told me within my own family; many other people must have in this way a direct link with the days of the industrial revolution.

But within the lapse of this short century we hold that because a thing is, so it shall always be. Uneasy doubts are met by affirming that "it will last our time," for construction and reconstruction are indeed troublesome tasks, not to be achieved by existing in a series of reflex actions, such as catching the nine-fifteen. But nothing does last our time, as a whole, especially nowadays; not only does our-all important personal experience of a century continue to be a mere string of ripples on a changing surface, as always, but the rate of change in social relationships and trade is now accelerated by accelerated transport of materials, of persons, and of ideas. It may even be that the child of next generation will have the thrill of growing up in surroundings which he knows to be unstable.

By such unbusinesslike paths we arrive at a safe inference that business methods which were formerly sound, may no longer be fitted to present conditions. That long time-lag in the adoption of new methods to suit new surroundings which is caused by egocentricity, by the conservatism of mental indolence, and by the lengthy overlap of our individual lives, was no handicap when conditions changed slowly. Only when polytheistic ancient Egypt was revolutionised by Akhnaton, or when Watt's steam-engine revolutioned western industrial procedure, did the time-lag get in its good work; Tell-el-Amarna was razed to the ground; Cambridge railway station was located inconveniently.

Thus the transition from muscle-power to steam-power, which we denote as the Industrial Revolution, brought in its train a number of secondary consequences which seemed perfectly reasonable in 1800, but the intervening years have seen some of them disavowed by the community; such, for instance, as the farming-out of workhouse children to live, labour, and sometimes to die in the cotton mills. Others of them are still in process of attaining general discredit, such as juvenile labour, industrial fatigue, and the smoke-pall. Such discredit is attained, be it noted, not by mere philanthropy, but by realization of the horrid fact that if the scale on which the books are kept is big enough, these things do not pay.

Now, among the secondary consequences which still survive, there is a belief in the industrial value of secrecy. It is a survival from the industrial revolution, and not an inherent necessity. Compare it with the communal craft of the older trade guilds of the middle ages. These had their semi-ritualistic secrecies, of course, because a certain number of secrecies are good for a man,

as fleas are for a dog but the main object of these guilds was altruistic, the diffusion of skill and knowledge. Secrecy took upon itself a very different aspect when our short-sighted world stumbled amazedly into the avenues of achievement which this first conquest of energy so suddenly revealed. The possible ends seemed to justify any minor inconveniences at first, even to the thoughtful pioneers, and anyhow, it was the grabbers who set the pace. So while children worked only fifteen hours a day if they were fortunately placed, and while the filth of smoke was regarded with genuine affection for being a sign of " prosperity," so the non-humane vice of selfishness was exalted and rechristened as sturdy independence.

The method worked for quite a long while. There were no competitors while the long start given to Great Britain by the genius of a few inventors was being exploited, while the conditions and difficulties were simple. But as competitors arose, and especially those more fortunate owners of " white coal," the long start was steadily overhauled. Also, we were apt to forget that the scratch man has to travel faster than ourselves in the overhauling effort, even if he does happen to be a long way behind. So the conditions have become more complex, the difficulties more insidious, and the interdependence of one thing upon another has begun to be more obvious. Sturdy independence begins to recognise the value of team-work.

Team-work has its own dangers if it is pursued in any other than the sporting, altruistic, spirit, but it is superior to any formal organization when so pursued, while if such an organization can also work as a team, it is perfect. But team-work is inevitable for the success of our complex modern industries, as can most clearly be seen in the newest side thereof, the industrial research laboratory. Such institutions utilise a variety of abilities and learnings which only a team can provide, and even then each specialist therein must be something of an Admirable Crichton; any member thereof who tries to be secretive should be protected by sex or infirmity only from kickings.

It is not so instantly apparent that other sides of industry need the same degree of co-operation in order to obtain comparable efficiency in their own particular fields of work, though we can see that such need is being recognised when the *Times* allocated blame in equal parts to miners and to owners in the recent coal dispute. But team-work does not stop inside the firm, combine, or industry. The co-operation of industries within the state is just as important, and so, eventually of the states themselves. Though this last is as unthinkable today as was the disappearance of the Border-line to our great-great grandparents, Scots or English, yet it must come. For the scientist it has come already.

So modern industry is perceptibly moving away from the old secretive, dog-in-the-manger policy, recognising its futility. Co-operation requires frankness. Knowledge unsatisfied demands intercourse to become power. The change, or the coming change, is not so much due to realising that the development of industrial research has made secrecy futile, because processes can be inferred from examination of the product, as because of the bald fact that the giver always receives much more than he can give. This is again most obvious in scientific work, and as any industry becomes more technical and scientific, so much the less can it be self-sufficient. Robinson Crusoe practised industry in isolation for fifteen years, but he could not have done much research while deprived of that co-operation from which we scientists benefit, in the form of books, instruments, journals, discussions, and criticisms.

In sum, secrecy in a technical business no longer pays, and the honesty of frankness is eventually the best policy, for we are becoming too beastly technical, and when one competitor employs the aeroplane there is little business left over for another who tries to go there by paddling his own canoe.

RHODESIAN TOBACCO.

Steady Progress in Oversea Markets.

THIS year's production of tobacco in Southern Rhodesia is estimated at 6,000,000 lb. Very favourable results have followed the introduction of Rhodesian tobacco to the United Kingdom market, and it is felt that, given a steady and increasing supply and a continuance of the tariff preference accorded to Empire-grown tobaccos, Rhodesian growers can count on retaining a share of the British Market.

In the early days of tobacco cultivation in Southern Rhodesia the results were disappointing, principally owing to the restricted local market and the lack of organization. Co-operation, combined with good management and helped by the Wembley Exhibition, has brought about a great improvement in the returns and has led to a substantial expansion of the industry. Indeed, the production of fine leaf tobacco is now generally regarded as the most promising cultivation in the Colony. A large proportion of the cultivable soil will produce excellent tobacco, the climate is thoroughly well suited to the preparation of the leaf, and the return per acre is greater than in the case of any other crops grown in the Colony on a large scale. Experience is teaching the growers how to minimize the bad effects of abnormal weather conditions, and as time passes the risk of crop failures, due to excessive rains or drought, will be further reduced.

African tobacco manufacturers now have agencies not only in Europe, but in Australia, New Zealand, and China. The demand for the product of their factories is increasing rapidly, especially in Australia.—*Times Trade and Engineering Supplement.*

THE CHEMIST AND TROPICAL AGRICULTURE.

BY DR. T. A. HENRY, Wellcome Chemical Research Laboratories, London.

IN a certain narrow sense the chemist may be regarded as the predestinate enemy of the tropical agriculturist. Thus his success in making indigotin and vanillin, by processes capable of industrial exploitation, has meant the virtual disappearance of indigo-planting and a diminution in the demand for vanilla. Rubber and camphor have also been made in the factory, but neither is a real danger to the natural product at present—in itself a hopeful augury of the possibility of planters making a better stand in the future against the competition of synthetic materials, than they have sometimes done in the past. On the other hand, synthetic menthol and thymol seem to be making headway.

In justice to the chemist it should, however, be pointed out that the introduction of synthetic products quite frequently means a change in planting industry and not the mere extinction of a fraction of it. Thus, of the six materials mentioned above, the only one which does not make use of an agricultural or forest product as a starting point is synthetic indigo, which is made from naphthalene obtained from coal. In the production of vanillin, the chemist begins with eugenol and this has meant an increased demand for oil of cloves. Similarly the manufacture of thymol from p-cymene has created a new market for this hydrocarbon, obtained as a by-product in the manufacture of sulphite pulp from coniferous timber. Menthol is being made from thymol, but other possible sources are piperitone from *Eucalpytus piperita* oil, pulegone from pennyroyal oil and indirectly citronellal from citronella oil. It may reasonably be argued therefore that, so far, what the synthetic chemist has done is not to diminish the total activity of the tropical agriculturist, but to lessen the range of his crops. This is no doubt serious enough and it probably does not comfort the planter to know that some of these recent invasions of his preserves have been made by British chemists, whereas he used to expect them only from Germans.

Though the planter has so far had but little reason to thank the organic chemist for his activities, he should not overlook the desirability of enlisting these services on his own side. Much has already been done by chemists in connection with the investigation of soils, and in the chemical control of estate factories for sugar and other products, but there is good reason to believe that possibilities of assistance in other directions have been overlooked.

The author recently had occasion to give a short course of lectures on. "The Secondary Components of Plants" to honours chemical students at the Battersea Polytechnic in London. In these lectures an attempt was made to trace a connection between the groups into which botanists classify plants and the groups into which such constituents of plants as alkaloids glucosides, pigments, essential oils, &c., divide themselves, on those cases where their constitution has been fully determined by chemists. Thus to take an example, a chemist beginning work on any of the uninvestigated species of *Aconitum* would expect to find alkaloids present, and would be surprised to find any alkaloid, which did not belong to either the "aconitine" or the "arisine" type. That expectation is based on the fact that of the numerous aconites so far examined all have yielded alkaloids, belonging to one or other of these two types so that in this genus the characteristic component shows but little variation.

On the other hand the essential oils derived from the single genus Eucalyptus exhibit great variation including several distinct types characterised by such different principal constituents as the hydrocarbon, phellandrene, the organic oxide, cineole, the ketone piperitone, and the unsaturated aliphatic aldehyde, citronellal.

These are but two examples of a mass of unassorted information, which exists among chemists interested in the investigation of plant products, information which needs extension and systematisation, but which even in its present form is extraordinarily useful in furnishing clues to the constituents likely to be present in little known plants. Chemists engaged in industries using vegetable raw materials, constantly make almost unconscious use of such information, when plant products of the type they require are submitted from new sources.

So far as the author is aware only one reasonably complete investigation of the kind required to provide such systematic information has been made *viz.*: that by Baker and Smith in Australia on the composition of the oils obtained from practically all the species of Eucalpytus. Apart from its fascination from the point of view of the correlation of the botany and the chemistry of the Eucalypts that work has resulted in important industrial developments, such as the use of certain types of eucalpytus oil for commercial mineral separation and the introduction of piperitone into commerce. It is reasonable to suppose that similar work on other genera might also yield results of immediate economic importance.

Another interesting field for joint effort by chemists and botanists is the investigation of the methods by which these secondary components are formed in plants. Some years ago Prof. Robert Robinson put forward an explanat on of the production of a whole series of alkaloids in plants, starting with simple amino-acids, such as are likely to result from the hydrolysis of vegetable proteins. He succeeded in making that scheme look probable by synthesising two naturally-occurring alkaloids tropine (the nucleus of atropine) and *pseudo pelletierine* by using substances substances, which occur or could occur in plants, and simple reactions which took place at

atmospheric temperatures. This is probably the most notable advance yet made in this direction. Like most researches, which begin by being recondite, it has already had practical applications and psicaine, a synthetic isomeride of cocaine has been made commercially, by what is really a slight extension of Robinson's methods. Psicaine, it should be explained, is not cocaine and though it has similar properties, recent medical reports indicate that, like most of the cocaine substitutes so far introduced, including borocaine to which Professor Hardy referred in a recent number of this Journal, it is not an effective all-round substitute for this alkaloid. It is, however, significant that on the chemical side, Professor Robinson's views have led to economic developments, whilst they have, so far as the author is aware, stimulated no biologist into activity, though they obviously suggest many new lines of work for biologists and bio-chemists

In a former number of this journal Dr. Hill, Director of the Royal Botanic Gardens, Kew, has pointed out that there are two varieties of the camphor tree, distinguishable only by the fact that one yields camphor and the other camphor oil, a less valuable product. Unfortunately the camphor trees, which have been introduced into various British tropical colonies belong for the most part to the second variety. The net result of this is presumably that in spite of a good deal of work little progress has really been made towards camphor production in the British Empire. Recently a good deal of attention has been devoted in the press to the Dutch monopoly in cinchona bark and the suggestion has been made once more that the Empire should produce all the cinchona bark it requires. In this connection it is worth mentioning that when the Germans were in possession of East Africa they formed experimental cinchona plantations at the Biological-Agricultural Station at Amani. Since the war small quantities of cinchona bark have been stripped in these plantations and have been examined at three different institutions in London. Each time it has been found that some of the barks yield a complex mixture of alkaloids such as is found in *Cinchona succirubra* bark whilst others differ but little in quality from good Java 'factory' bark and contain quinine as their principal constituent The trees yielding these two types of barks are said to be indistinguishable in appearance. This trouble is not unknown in cinchona plantations in India and Java but, there, it appears to be much less marked that at Amani. From an economic point of view this is a matter of great importance, for the accidental inclusion of any considerable proportion of "succirubro" bark in "factory" bark intended for the manufacture of quinine would probably lead to its rejection. In both these cases camphor and cinchona, it will be noted that it is a well-defined and recognisable chemical, that is absent or present. Instead of having to trust to luck as at present and to waste time in allowing useless plants to mature, it ought to be possible in cases like this to devise a micro-chemical test for application to seeds or to young seedlings with a view to the elimination of poor material at an early stage.

These three groups of problems (*a*) the correlation of chemical composition with botanical relationship (*b*) investigation of the processes by which secondary components of plants are formed (*c*) discovery of new methods for distinguishing between valuable and valueless varieties of economic plants are merely suggested as examples of problems, which chemists and especially bio-chemists should be encouraged to tackle. There is little sign of such work being attempted on any considerable scale except perhaps in the Dutch East Indies, and occasionally, especially in regard to essential-oil-plants of local importance in France and the United States.

Bio-chemists everywhere seem to be mainly concerned with the animal organism and it is for the tropical agriculturist to call attention now and again to the fascinating problems awaiting solution in his domain.

From his point of view work on such subjects as these would have two advantages; it might yield results of economic importance and it would serve to train a race of chemists interested in and capable of, dealing with problems of tropical agriculture. Such men are sure to be needed sooner or later in connection with research associations dealing with industrial raw materials derived from the Tropics, such as rubber, cotton, cocoa, &c., and it would be all to the good to be ready for such a demand. Work of the kind suggested above must be done where the plants grow, that is in the Tropics and one way of encouraging it would be for the Imperial College of Tropical Agriculture to offer special labaratory accommodation to post-graduate students of British Universities desiring to undertake such investigations. It might even be feasible to induce holders of research fellowships in bio-chemistry to spend part of their time working in Trinidad.

Much of the work done by Dutch chemists on plants has been accomplished in this fashion by making special arrangements for research students to work in the laboratories maintained in connection with the Botanical Gardens, at Buitenzorg in Java.

ADVERTISEMENTS.

Mr. Henry H. R. Mole, of Little Neck, Long Island, New York, has been appointed advertising agent for *Tropical Agriculture* in the United States of America and Canada. All communications from those countries respecting advertisements should be addressed to him. The address of our advertising agent in the United Kingdom is 14, Trinity Square, London, E.C.3. Firms in the West Indies and British Guiana are requested to address their communications to the Editor, *Tropical Agriculture*, Imperial College of Tropical Agriculture, Trinidad.

TROPICAL WORLD NOTES.

India.

According to a report issued by the Department of Commercial Intelligence and Statistics, Calcutta, the number of reporting coffee plantations in India for the year 1924-25 was 3,116, covering an area of 244,654 acres, as against 3,087 with an area of 232,198 acres in 1923-24. New land planted with coffee in these plantations during the year amounted to 6,297 acres, while the area of old cultivation abandoned was 2,414 acres. This represents a net increase of 3,883 acres over the total area (138,046 acres) under coffee in 1923-24. The total reported area under cultivation in the year 1924-25 was, therefore, 141,929 acres, or an increase of 3 per cent. Of this total area, Mysore accounted for 51 per cent., Madras 24 per cent., Coorg 23 per cent., and Cochin and Travancore together 2 per cent.

The total reported production of cured coffee during the year was 30,475,644 lb., as compared with 19,145,403 lb., in the preceding year—the yield per acre of plucked area being 303 lb. (141 lb.) in Madras, 218 lb. (169 lb.) in Coorg, 201 lb. (177 lb.) in Mysore, 202 lb. (158 lb.) in Travancore, and 176 lb. (100 lb.) in Cochin. Exports of Indian coffee increased from 218,000 cwt. in 1923-24 to 242,000 cwt. in 1924-25. The principal customers of Indian coffee are the United Kingdom and France, the former increased her requirements from 73,400 cwt. to 75,300 cwt., and the latter from 63,100 to 67,700 cwt. Of other European countries Germany, the Netherlands and Belgium increased their takings, while Norway took less. Exports to Mesopotamia and Bahrein Islands also increased, while those to Arabia and Australia decreased. In the year ended March, 1926, the shipments amounted to 255,000 cwt.—*Chamber of Commerce Journal.*

Gambia.

According to the Gambia Government Gazette (Extraordinary) of 25th March, 1926, the most important article—Kola-nuts—from a revenue collecting point of view, showed a serious decrease of 3,327 cwts. in the quantity imported during 1925 as compared not only with the previous year, but also less than that imported for the past ten years with the solitary exception of 1917. Only 12,332 cwts. of this commodity were imported during the year under review, while, for instance in 1920, 23,334 cwts. were consumed by the natives. The Colony's ground-nut crop—the smallest since 1916—was exceedingly poor and this fact militated largely against the purchasing capacity of the native consumers. In exports also the Colony has fallen short of previous shipments, goods to the value of £722,621 having been exported during the year, as compared to £893,359 in 1924, the reason for this being, as already mentioned, the poor crop of ground-nuts. The total value of imports for the year, however, was £615,927 being £53,773 less than the 1924 imports.

Southern Rhodesia.

The *African World* recently published extracts from the Land Commission in Southern Rhodesia appointed to inquire into the expediency and practicability of defining areas outside the native reserves within which (*a*) natives only may acquire ownership of or interest in land, and (*b*) Europeans only may acquire such rights.

The Commissioners report that " it is obviously impossible to estimate with any degree of accuracy the relative numbers of the two races who are likely to form the population of Southern Rhodesia in twenty, fifty, a hundred, or more years' time, nor their relative wealth and needs as regards land. The statistics published in the Year Book indicate that the natural increase of the European population, apart from emigration, is somewhat greater than that among the natives at the present time, but there appears to be a general tendency to doubt the accuracy of the returns in this respect and the majority of those who are most conversant with the native are of opinion that the latter is increasing more rapidly . . . In our opinion the native population will probably show greater increase in the future.

Discussing the reasons which led to their verdict as to the practicability of the segregation idea the report says that the area of Southern Rhodesia is approximately 96,250,000 acres, of which 31 million acres have been alienated to Europeans and 21,600,000 have been set apart as Reserves for natives, leaving over 43,000,000 acres for future allocation. If the policy of separate areas is to be adopted, the present is the time to apply it, otherwise the conditions are likely to become more difficult. The practicability of this policy depends upon a willingness on the part of the white race to do justice, and involves the willingness of the members of the Legislative Assembly, representing the voters, to support legislation which will ensure a fair proportion of land being set apart for native acquisition. In law, as at present, the two races have equal rights outside the Reserves.

The desire of the whole population, black and white, who are interested in and understand the question is, generally speaking, in favour of separate areas, but it is in fact the white element of the population which originally asked for an amendment of the law in this direction, and it depends upon the votes of members of the Legislative Assembly, who, to all intents and purposes, have been elected by that portion of the community, whether any alteration of that law should take place ; it is for them to determine to what extent they are willing to surrender their rights in order to obtain the benefits which the policy of separate areas will bring to the white community. Unless they are prepared to surrender these rights to an extent which is considered by the Government of the Colony and the Imperial Government to be fair and equitable to both Natives and Europeans, presumably no alteration in the Constitution will come into being.

Kenya and Uganda.

Cotton and coffee are by far the principal items in the export trade of Kenya Colony and the Uganda Protectorate, although hemp, hides and skins, and carbonate of soda each exceed £200,000 in value, the first-named of the three last year actually reaching £530,000.

The bulk of the coffee shipped is from Kenya Colony, whose exports last year totalled 147,257 cwt., valued at £823,901, as compared with 29,884 cwt., valued at £140,019 by Uganda. The combined value of the coffee exported last year accounted for 12 per cent. of the total domestic exports. Great Britain continues to be the principal market, and took 145,542 cwt., to the value of £817,058. South Africa and France were also important purchasers. Compared with 1924, exports of coffee last year showed a decrease of over 20,000 cwt., but this was somewhat compensated for by the higher prices ruling for coffee during the year.

Cotton easily heads the list of the combined exports of Kenya and Uganda. Last year total exports reached 785,849 centals, the value amounting to no less than £4,694,359 as compared with 515,095 centals, valued at £3,489,329, in 1924. Within two years this trade has more than doubled, and to-day accounts for at least 60 per cent. of the total exports of the two territories. Uganda, of course, is the great contributor, and her output of raw cotton continues to increase. Last year this Protectorate was responsible for no less than 784,153 centals of the total cotton exported, the value amounting to £4,685,992. Of the combined shipments from Kenya and Uganda, 51 per cent. went to Great Britain and 40 per cent. to India, but it is possible that a considerable proportion of the cotton shipped to the Bombay market was subsequently re-exported for consumption in Japan or Great Britain.—*Chamber of Commerce Journal.*

Tongan Islands.

According to the Colonial Office Report for the Tongan Islands Protectorate for 1924-25 (No. 1291) imports and exports during the financial year ended 30th June, 1924, amounted in value to £232,600 and £306,658, in comparison with £195,220 and £267,609 respectively in the corresponding period of the last year. Included among the chief contributors of exports were the United Kingdom, the United States of America and Japan. The estimated revenue for the year ended 30th June, 1925, was £74,335 as against a sum of £81,023 realised in the previous year. The expenditure, though £1,743 more than the previous year when £61,796 were expended, was the lowest since 1920, excluding the 1923-24 financial year. Agriculturally, the output of copra has experienced a steady rise, due to the fact that every Tongan taxpayer is compelled by legislation to plant in coconuts a certain proportion of his tax allotment of 8¼ acres, thereby bringing into cultivation fresh areas.

Mozambique.

A correspondent of the *African World* reports that, "both in the Mozambique Company's Territory and in state administered districts of Portuguese East Africa, there is a strong disposition to criticise the recent agreement between the Province of Mozambique and the two Portuguese cocoa growing islands of Sao Thomé and Principé, off the West Coast of Africa, which permits the latter to recruit 3,600 native labourers annually in Mozambique. The recruiting will be done mainly in the Mozambique District from which labour is drawn for farms and plantations in other parts of the Province and in the Territory of Manica and Sofala."

In view of recently expressed opinions in the Lourenco Marques district that the supply of natives for work in the Transvaal and Southern Rhodesian mines withdraws labour from Portuguese East Africa that could be better employed in developing local industries, it is regarded as somewhat surprising that this extension of the principle of exporting labour from Mozambique should have been agreed to by the Provincial administration. Although there are between three and four million natives resident in Portuguese East Africa, there is no large surplus of boys willing to work for European employers, and the problem of recruiting adequate labour forces is constantly before employers, whether they be individuals or companies. This is also the case in the British South and East African Territories, so much so, that it was reported some time ago that Kenya was endeavouring to secure authorisation to obtain labour from Portuguese East Africa.

As the development of the Portuguese Colony proceeds, a reconsideration of the attitude to be adopted towards permitting the recruiting of native labour for work outside Portuguese Territory will be necessary, and if the Provincial Government is able to carry out its programme of railway and irrigation works in the Limpopo Valley and elsewhere these developments, together with the important works to be put in hand shortly, and near Beira, and in the Zambesi Valley, will speedliy bring about conditions in which all available native labour will be needed within the Portuguese domain.

BRITISH AMMONIUM SULPHATE.

The British Sulphate of Ammonia Federation, whose products are described in an advertisement published in this *Journal*, will readily send literature to anyone interested in the use of nitrogenous fertilizers. It is unnecessary for us to stress the well-known value of ammonium sulphate in tropical crop production. The characteristics of modern preparations of this fertiliser have been stated in certain "Chemical Notes" in this *Journal*, and we have no hesitation in stating that the most exacting requirements will readily be met by the Federation.

BOOK PROTECTION.

In recent numbers of *Tropical Agriculture* there have appeared two articles containing information as to the protection of books from the attacks of certain insects. These were contributed by Sir Arthur Shipley, G.B.E., F.R.S. One of them, entitled "Enemies of Books," is to be found in Vol. II at pages 223 and 244 and the other, "Bookbinding in the Tropics," in Vol. III, page 141. In both these articles frequent reference is made to a book solution containing corrosive sublimate, carbolic acid and alcohol. An account of this solution for preserving books was given in the *Agricultural News* for 16th August, 1902 (Vol. I, p. 140) when the statement was made that "this solution does no damage to the books and has been proved by many years test to be an efficient protection. Books should be repainted with the solution every two or three years." For making this solution the following proportions are there recommended.

1 ounce corrosive sublimate.
1 ounce carbolic acid.
2 pints methylated or rum spirit.

This solution has been in constant use in the library of the Imperial Department of Agriculture and the Imperial College of Tropical Agriculture and its use has given a very fair degree of protection to the books treated with it. The solutions mentioned in Sir Arthur Shipley's articles as being useful for this purpose in the tropics in different parts of the world are the same as this or slight modifications of it.

Professor R. R. Hall, Harrison College, Barbados, some years ago, developed a solution in which arsenic provides the poisonous principle and Professor Hall found it to be much more satisfactory than the other in that it gave a greater degree of protection, that it persisted in its protection for a much longer period, and was more agreeable to use.

Professor Hall has recently been kind enough to forward notes on this arsenical solution from which the following information is taken. The solution is prepared by dissolving 12 grammes (the weight of two half pennies) of white arsenic or arsenious acid, in the smallest possible quantity of ammonia solution, by boiling or digesting over or in a water bath. At least 300 c.c. or ½ pint of the liquid will be required to effect solution. The arsenic should be moistened with a few drops of alcohol, two fluid ounces of strong ammonia solution and four fluid ounces of water are then added and the mixture boiled till complete solution is obtained, stirring vigorously while heating up to boiling.

This solution is diluted with alcohol to make two quarts of book solution. If strong rum spirit or methylated spirit is used it may be diluted in the proportion of 5 parts of the spirit to 3 parts of water. If desired, ½ ounce of naphthalene may be dissolved in the spirit before diluting.

For use, this solution is applied in the same manner as that containing the corrosive sublimate. With a flat varnish brush the angles of the binding are painted over and the inside and outside of the book also, with a light application of the solution and in the case of very thick books it is recommended that the book should be opened at one or more places and the solution painted into the binding. The treated books are stood up to dry with the covers and leaves opened out to let the air get to the treated surfaces.

The solution being alcoholic is injurious to polished and varnished surfaces, and it is very poisonous and the container should be labelled "Poison."

Professor Hall has found this solution to be equally effective for use on attaché and despatch cases, hat boxes, suit cases, trunks, photo frames and, in fact, all articles of paper, cardboard, leather and its imitations, and cloth.

In the West Indies, particularly in the Lesser Antilles, the principal injuries to books are inflicted by beetles, cockroaches and the silver fish. The silver fish or bristle tail, eats the paste in bindings and the surface glazing or sizing from certain kinds of paper when exposed to its attack. Cockroaches eat cloth bindings, particularly in certain colours. The beetle lays its eggs in the angle of the bindings or other suitable place in the book and the grub penetrates the binding and the cardboard of the cover and even bores holes through the pages of the book.

If books are given good care and treated with the book solution from time to time (at intervals of several years) the beetle can be prevented from doing damage. Cloth covered books may be slightly injured even after treatment by the gnawing of the roaches and silver fish before the insects absorb enough poison to cause their death. The dyes producing certain colours in the cloth bindings seem to have an attraction for roaches and even when these are repeatedly treated (with the corrosive sublimate solution) the injury is often progressive.

Injury by termites is of quite a different character. If bookcases stand on wooden floors or are backed against walls or partitions the termites may gain access to the books in spite of any treatment, and once the barrier imposed by poison treatment is passed the termites, by reason of their enormous numbers and their community action, are able to accomplish great havoc in a very short time. In the case of these insects the protection of books is fundamentally a matter of preventing the termites from gaining access to the bookcases. Certain woods are more or less immune from termite attack, and the immune kinds of wood which may be had in any locality are usually well-known. If such woods are used for the construction of book cases, there will be no danger of attack on the books by termites living in the material of the shelves. If in addition, the book cases are protected from invasion from without by those species of termite that build galleries under cover of which they forage for fresh feeding places, then the books should be free from attack. Termites however are persistent and in

localities where these insects are most abundant and most active, eternal vigilance is required to ensure protection against their attack.

In the second part of Sir Arthur Shipley's article, "Enemies of Books" referred to above, mention is made of the difference in the degree of attack by pests on books from different sources, and the statement is made (quoted from Mr. W. C. C. Dunlop, Barbados) that French and German bound books are absolutely immune. In the experience of the present writer, extending over many years, American bound books are much less liable to attacks of the beetles than books from British publishers, and this difference is to be found in all kinds of card-board material. Books of British and American origin, card-board boxes such as those in which photographic plates and stationery are obtained, photo frames and other articles of which card-board forms a prominent part, when kept on the same shelves or under the same conditions always emphasize this point that the British made material is more quickly and more severely attacked than the American.

Books bound in the West Indies, where copper sulphate is usually added to the bookbinding paste, are much less liable to attack by beetles than most imported books.

On the other hand, roaches seem to have a great preference for certain American bindings in cloth, especially certain black and blue cloths. In some instances attacks by roaches and, perhaps by silver fish also appear to follow the handling of the books for these often show injury at the backs where the cloth might have absorbed perspiration from the hands of the user.

In the case of the roaches, however, there would seem to be no doubt that the quality of the dye used in the cloth is the great attraction. Such bindings and, in fact, all cloth bindings might be protected from these attacks by the addition of a small amount of shellac to the book solution. Fumigation with carbon bisulphide is useful in freeing books from pests, but it cannot always be depended on to completely destroy the termites in books as these insects seem to build locks or barriers in their tunnels which check the diffusion of the poison gas.

In book cases which are tight-built with well fitting doors, a small amount of flake naphthalene on the shelves is a deterrent to many insects. It is largely used in this way in cabinets containing insect storage boxes, as well as in the storage boxes and in exhibition trays.

Another use to which the corrosive sublimate-carbolic solution may be put is the repression of moulds and mildews. It is used in insect collections for the protection of the individual specimen, applied with a fine sable brush to each specimen showing the mould, and is very useful for treating the interior of wooden cabinets in which the storage boxes and trays are kept.

In Trinidad books and papers kept in open shelves suffer minor injury from the mud wasps or mason bees, as they are called, those indefatigable solitary wasps which build mud nests stored with spiders, living but paralyzed and helpless, waiting to be devoured by the offspring of the beautiful insect which put them there.

These nests may be built on the outside of the book but certain species, will get down into the binding of the book or into the centre of a roll of paper or into the angle of a fold in papers, and in an incredibly short space of time a very large quantity of mud is built into these places where, to say the least of it, it is not wanted.

Eternal vigilance is the price of liberty in the protection of books in the tropics and when combined with the use of some of the materials suggested in this and the previous articles referred to should provide a fair safeguard from serious attacks.

H. A. B.

THE POLLINATION OF THE OIL PALM (*ELÆIS GUINEENSIS*).

BY A. G. G. HILL, B.A., AGR.B., A.R.C.SC.I., AND T. G. MASON, M.A., SC.D., AGR.B.

THE first step in the propagation of superior types of oil-palm is evidently the elaboration of a method for growing trees of known parentage. Inasmuch as vegetative propagation is impossible the need of controlling pollination is evident. The oil-palm is monoecious, male and female spadices occurring on the same tree but at different periods; bisexual inflorescences are rare (cf. 1). Inasmuch as the flowers are visited by numerous weevils, it was thought probable that pollination was normally dependent on insects. Proceeding on this assumption, calico bags were employed in the first instance to prevent cross-pollination. It was found, however, that even when the flowers were not artifically pollinated, fruits developed. It became evident therefore that not only were insects not essential for pollination but that a new type of bag was required. The calico bags were accordingly replaced by green Willesden canvas bags treated with mineral oil. In order to facilitate inspection of the spadices without exposure, small circular windows were let into the bags. The bags, which were approximately twice as large as the inflorescences, were fitted some four days before the stigmas became receptive. Before bagging the spathe and encumbering leaves were cut away. The spadix when exposed was washed with 0.1 per cent. formalin and the bag securely tied over a grease band on the peduncle. Supports were placed inside the bag in order to prevent it touching the flowers. When the stigmas were judged to be receptive, the window was removed and the pollen introduced through a glazed paper pipe. The pollen was stored in calcium chloride desiccators. The controls, which were not pollinated, were opened when the stigmas became receptive as in the case

of the inflorescences that were pollinated. The bags were removed when the stigmas withered, and all immature flowers removed.

The results which are shown in Table I seem to indicate that the method is satisfactory and that the pollen may be stored for a very considerable period. The paucity in the number of inflorescences handled is due to the fact that the method finally elaborated was not ready until the close of the autumn flowering cycle. The results are presented as they appear to be conclusive. It is interesting to note that self-sterility is not apparently an obstacle to self-pollination.

Table No. I.

Treatment.	No. of Spadix.	No. of Fruits Developed.	Age of Pollen in days.
Controls Not Pollinated	1	—	—
	2	—	—
	3	—	—
	4	—	—
	5	—	—
	6	—	—
Pollinated	7	570	16
	8	54	3
	9	830	1
	10	338	30
	11	17	60
Self-Pollinated	12	517	22
	13	60	84
	14	118	80

Fourth Annual Bulletin of the Agricultural Deparment, Nigeria.

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(1) Mason, T. G. and Lewin, C. J. (1925).
Sex and Correlation in the Oil-Palm *Elæis guineensis*. *Annals of Applied Biology.*

FOOD VALUE OF THE BANANA.

[*The following account of those features which render the banana one of the best of foods, is taken mainly from a booklet compiled by Messrs. Skinner, Sherman and Esselen, and published by Mr. W. M. Leonard of Boston, U.S.A. It is through the kindness of this last-named gentleman, who sent us a copy of the booklet, that we are able to present this information.*]

THE banana is more than a delicacy; it is a substantial food. In food value, it ranks highest among all fresh fruit, and surpasses most of the vegetables. Apples, pears, peaches, oranges, and berries contain nearly 90 per cent. of water, whereas the moisture content of the banana is less than 75 per cent. Contrary to the usual opinion, the banana possesses high digestibility. This applies, however, only to the *ripe* banana, for on ripening, raw banana starch is converted into fructose sugar. Hence young children thrive on ripe banana when ordinary starchy cereal foods, bread and potatoes, produce chronic indigestion. Moreover, the banana is enclosed in a skin which must be removed before the fruit can be eaten. This effectively protects it from contamination by dust, moulds and flies.

The banana and its near relative, the plantain, comprise the chief source of carbohydrate food of an enormous number of people in the tropics, taking the place of potatoes and cereals of northern countries. The actual amount of food per acre produced by the banana crop exceeds that of wheat or of any other plant, and its cost is low.

Chemical analysis.

The following figures compare the banana with the Irish potato. They are taken from Bulletin 28 of the United States Department of Agriculture, 1906.

	Banana.	*Potato.*
Water	73.3 per cent.	78.3 per cent.
Protein	1.3	2.2
Fat	0.6	0.1
Carbohydrate (total)	22.0	18.4
Salts (mineral matter)	0.8	1.0
Calories per pound	460	385

Below are given the comparative costs of different foods, including the banana, based on calorific value. (Boston 1925.)

	Cos per pound (cents).	*Cost per 100 Calories (cents).*	*Calories purchased for five cents.*
Corn meal	5	0.31	1,620
Beans, dry white	9	0.58	869
White bread	9	0.75	666
Rice	12	0.75	663
Potatoes, Irish	4	1.36	369
Butter	52	1.49	336
Cheese	34	1.71	293
Potatoes, sweet	10	2.18	230
Whole milk	7	2.26	221
Bananas	*7*	*2.33*	*214*
Mutton	30	2.43	206
Cabbage	5	4.35	115
Beef	39	4.38	114
Squash	5	4.76	105
Beans, string	10	5.56	90
Beans, fresh Lima	15	5.89	85
Eggs, raw	40	6.30	79
Oranges	12	7.06	71
Oysters	45	13.41	37
Tomatoes	15	15.80	32

Banana versus meat.

According to Professor S. C. Prescott, of the Massachusetts Institute of Technology, the banana contains all the classes of food materials required

by the animal body. Although the contents of protein and fat are too low to give a perfectly balanced ration, the combination of banana with milk is ideal. Meats are essentially protein foods, and are more adopted to the formation of tissue than to the quick production of heat and dynamic energy. The banana, on the other hand, is less a tissue-forming food, but is incomparably more efficient as a supplier of heat and dynamic energy. For the maintenance of bodily health, it is generally recognized that a ration should contain between four and five times as much carbohydrate as protein. If protein is in excess of this, it is merely excreted without being utilized. Fats and carbohydrates are mutually interchangeable as regards fuel value.

Mineral salts in bananas.

Mineral salts possses special significance in dietary. Whilst only relatively small quantities are needed by the animal body, yet they are absolutely essential to the body needs. Bananas are highly satisfactory as regards salts content. Moreover, the salts occur in bananas in neutral or basic form, which is not so harmful as the acid form in which salts occur in most other fruits. Phosphorus, calcium and iron are perhaps the chief mineral elements of food ; these occur in adequate quantity in the banana, as the following figures show.

PERCENTAGE OF EDIBLE SUBSTANCE.

	Phosphorus.	*Calcium.*	*Iron.*
Banana	0.031	0.009	0.0006
Apple	0.012	0.007	0.0003
Orange	0.021	0.045	0.0002

Vitamins in bananas.

Recent research in animal nutrition has established beyond doubt the supreme importance of accessory food factors commonly called vitamins. Chemical analysis alone fails to characterize foodstuffs completely, and nowadays stress is always laid on the vitamin content of a food before it is pronounced desirable and sufficient. It is known that the so-called vitamins A and B afford protection against certain diseases, and promote growth ; that vitamin C prevents scurvy, and that other vitamins ward off certain "insufficiency" diseases. Although vitamins have not yet definitely been isolated in the pure state from foods, nevertheless investigators have been able to estimate their comparative amounts in different foods by their quantitative effects on animals, such as rats and rabbits. Fruits and green vegetables furnish the principal sources of vitamins, and naturally the banana has not escaped examination with regard to its vitamin value.

Professor W. H. Eddy, of the Teachers' College, Columbia University, New York, recently stated that the banana contains twice as much vitamin C as previously reported, and that it compares well in this respect with oranges and tomatoes as protection against scurvy. In spite of its low fat content, its content of vitamin A is surprisingly high, being about one-twentieth, weight for weight that of fresh butter, even though containing three-fourths water. The banana is thus equal to green peas and other vegetables in vitamin A content.

As regards vitamin B, banana is somewhat lacking, although not altogether deficient.

Ways of preparing the banana.

In the tropics, bananas have long been used as vegetables for cooking. They may be baked, boiled or fried. As a vegetable, the banana should be used when not quite ripe, since the starch of the unripe fruit, unlike that of the Irish potato, is rendered highly digestible by cocking. For eating raw, and for dessert, the banana should be full ripe, with brown spots showing on the skin. In this state it may be given even to young children with highly beneficial results.

F. HARDY.

ANNUAL REPORT OF THE TUCUMAN EXPERIMENT STATION.

WM. E. CROSS, IN *Rev. Ind. Agr.* TUCUMAN, VOL. XVI (1926) PP. 145-190.

RECENT favourable legislative aid has enabled the Tucuman station to expand ; additional land has been purchased and new buildings erected. Among the important undertakings of the station which have conferred much benefit on Tucuman agriculture are the introduction of the valuable new canes P.O.J. 36 and 213, the introduction of Rhodes grass and winter alfalfa. Much work has been done in distributing improved seeds, and the station staff has been very active in disseminating information by lectures, &c.

As sugar is the principal crop in Tucuman, much of the activity of the station is directed toward this staple. Studies on new canes are being pushed ; also investigations on fertilizers. Experiments with the Reynoso system have shown that it does not result in a greater yield per hectare. Experiments have been made in planting erect canes and canes subject to lodging in alternate rows, with a view to ascertaining whether the tendency of the weaker cane to lodge could be counteracted ; the method appears to have some advantages. Six-year experiments have been made on planting different portions of the cane stalk—top, middle and bottom thirds ; the results in the three cases were about the same, with a possible slight advantage in favour of the top third. New and improved cultural methods adapted to Tucuman are discussed in detail.—*Facts About Sugar*, July, 1926.

PSYCHO-ECONOMIC RESEARCH.

By W. R. DUNLOP.

IN recent years a great deal of anthropological research has been carried out in tropical countries with a view to the acquirement of knowledge concerning customs, beliefs, and social organisation, as well as the physical measurement of racial types. Periodically appeals for State assistance appear in the British Press, and there is no doubt that our own Government and those of tropical countries have for the most part failed adequately to support what is both an interesting and important line of research. I am of opinion, however, that the study of tropical peoples would be greatly stimulated if more attention were given to their industrial or psycho-economic characteristics and less to their purely social characteristics. A few facts and suggestions in connection with this aspect may prove of interest to readers of the *Field*, especially those concerned with tropical development.

In the course of investigational work in the West Indies and other parts of tropical America, where the population is notoriously cosmopolitan and "mixed," I have been struck by the remarkable differences in what may be termed the "economic idiosyncrasies" of the various racial and geographical types. For instance, in Trinidad, the West Indian negro is notably unthrifty in contrast with his East Indian (immigrant) co-worker. I found on one large estate, during an average fortnight, that out of 40 East Indian male labourers (selected at random) only 6 were in receipt of advances before their wages were due, whereas out of 40 West Indians, 40 received advances. Of 30 East Indian female labourers, none was in receipt of advances, but out of 30 West Indian female labourers 27 received advances. Another source of statistical evidence—the native farmers mutual credit societies—afforded additional proof, most of the East Indian Societies being in a much stronger position than the West Indian. It is true that this difference in the races is common knowledge among local people in a general way, but it is only by statistical measurement that the differences can be scientifically investigated and clearly and indisputably demonstrated. In regard to Trinidad it is further interesting to note that during the cacao crisis (1921-23), an insolvent condition characterised the position of the French Creole owners of the big estates, whereas solvency was quite noticeably typical of the more temperamentally cautious immigrant Barbadian owner. A very important line of study is the investigation of the question as to what extent such differences are due to environment, and to what extent they are in-born or congenital. There is practically no definite scientific knowledge on this point.

Concerning the vocational ability of labour, it is common knowledge that West Indian negroes, and especially mulattoes, make in many cases excellent mechanics, whereas the East Indians do not, this is recognised in India itself, and is regarded as a factor inimical to industrial as distinct from agricultural and commercial development. The difference is partly physical and partly psychological.

In the matter of racial intelligence there are many differences observable. One of special interest is the fact that the so-called Carib of the Central American (Caribbean) littoral makes a notably fine schoolmaster and teacher in comparison with the other coloured races and types in the New World tropics. I obtained first hand evidence of this in British Honduras.

All such differences are of significance in the administration and development of tropical countries, and their causes need careful investigation. Why is it that in parts of West Africa the natives, with their deep-rooted fear of working in lode mines, will nevertheless do so willingly in some of these mines, as for example in certain gold mines in Ashanti? Is it a question of confidence and management? What scientific explanation is there for the fact that the West Indian negro will spend his money on European clothes to the extent of depriving himself of sufficient food? What accounts for the Tamil propensity to drink and immorality compared with the people of Northern India? It would certainly seem that the study of tropical races along these and other lines would produce results as interesting as, and probably much more useful than, purely social and historical enquiry. One very obvious application of the study of psycho-economic characteristics would be in connection with increased efficiency and better conditions of work. From a trade point of view the studies advocated would be useful in northern countries in regard to understanding and "analysing" the great tropical markets, which are becoming more and more the subject of competition in the world of commerce.—*The Field, 27th May*, 1926.

MALARIAL CONTROL.

A Report on Ceylon Plantations.

By SIR RONALD ROSS.

AT the end of last year Sir Ronald Ross at the invitation of a number of Companies operating in Ceylon, went there and, as a result of his tour has issued a Report to the Ceylon Association, London, on Malaria Control in Ceylon Plantations.

He deplores the fact that comparatively little has been done in many tropical domains against species of mosquitoes of the genus Anopheles that carry malaria, but remarks that much has been done in towns to free habitations of the Culex and Stegomyia genera of mosquitoes that usually breed in the environs of houses.

He submits alternative schemes for the financing of Malaria Control measures on plantations.

A.—That the planters contribute funds to the Colonial Malaria Department in order to enable it to inspect and advise upon Malaria Control for every malarious plantation as well as for the general population.

B.—To appoint one or more Plantation-Malariologists for the special purpose of dealing with plantation malaria—to work of course, in touch with the Government Malaria Department as much as possible but to be supported by the estates.

A table prepared by a rubber planter is given showing that the monetary loss from the shortage of trees tapped owing to incapacitated labourers was in ration to the spleen rate (*i.e.* the percentage rate of those exhibiting an enlarged spleen on examination as a result of malarial infection). The loss amounted to nearly £1,000 for five estates for the month of January alone and varied from nil on estate I on a hill (with a spleen rate of only 15 per cent.) to a sum of Rs. 5,579 on Estate IV on a plain with a spleen rate of 76 per cent. The increase of the spleen rates (and of the pecuniary losses) in the estates on the plain were due to the greater frequency of the breeding waters of the malaria carrying Anopheles there, than on the slopes of the hill.

In discussing the raising of money by subscription for scheme A or scheme B. Sir Ronald classifies the Ceylon estates in a way that doubtless coincides with other areas as follows.

Group 1.—Estates (chiefly tea Estates) which are above or outside the malaria range and on which only imported cases occur.

Group 2.—Estates within the Malaria range but, on which epidemics occur only occasionally.

Group 3.—Estates whose coolies become infected from adjacent areas such as neighbouring estates or towns or villages.

Group 4.—Estates whose malaria is due to their own mosquito breeding areas.

Amongst other suggestions he specifies the need for a continued search for the ideal larvicide and the definite labelling of the main carriers among the species of Anopheles in an area.

On an economic basis alone the undertaking would be worth while apart from the humanitarian aspect of the prevention of disease and death, for as Sir Ronald states the gain would be many thousands of pounds saved for an outlay of a few hundreds.

E. A. S.

Subscriptions to Lord Milner's Appeal for £100,000 as an endowment fund for the Imperial College of Tropical Agriculture should be addressed to the Secretary, Imperial College of Tropical Agriculture or to the bankers of the Fund, the Colonial Bank, 29, Gracechurch Street, E.C.

CUBAN SUGAR.

The Crop Reduction Law.

The details of the Cuban Crop Reduction Law as passed by the Cuban Congress have now been made public. The gist of the new regulations is as follows[1]: Grinding at the sugar mills during the next two seasons (1926-27 and 1927-28) is not to start till dates decided on by the Executive (which are generally expected to be the 1st of January each year); a penalty of $5 for each sack of sugar manufactured before that date will be exacted. A temporary production tax of $5 per sack of sugar is to be levied on all sugar produced which exceeds 90 per cent. of the crop estimated for each sugar mill during the year 1925, and the Executive will reserve the right to exact the same tax in either or both of the following seasons if thought necessary. The 90 per cent. crop quota is to be applied also to the colonos, and only the proportional amount of each colono's cane is to be ground by the mills concerned, as is also the mill's own cane. The quota of each mill is to be decided by the Executive, who will average the three leading estimates of the crop (Guma, Himley, and the Secretary for Agriculture) for the purpose of arriving at the figure. The succeeding yearly quotas will be fixed by a technical body under the direction of the Executive. Provision is made in the case of several mills under one ownership, that where drought, fires or other circumstances prevent one of the mills completing its 90 per cent., the deficiency can be made up in any other of the mills of that ownership.

Some of the mills this season have already exceeded their quota, but providing they ceased grinding within three days of the enactment of this new law, they are not to be subjected to any penalty. The 1925-26 crop is to be limited by the law to 4,758,993 long tons, but it is expected that owing to prior production in excess of the quota, the total will be more like 4,900,000 tons. According to Lamborn, the effect of the grinding season being delayed till January means that the Cuban crop of this year must last till well into January next year; in the past season as much as 250,000 tons was produced prior to 1st January so it is obvious that the old supply will have some four or five weeks longer wherein to be absorbed before the new crop sugars enter the market. This will tend to have a bullish effect on the market during the next six months.—*The International Sugar Journal*, June, 1926.

[1] We are indebted to Messrs. Willett & Gray's full translation of the Cuban document, from which we derive our summary.

DAMAGE TO MAURITIUS SUGAR CROP.

Reports received at Johannesburg, indicate that damage to the amount of almost $5,000,000 was done to the Mauritius sugar crop by the recent heavy cyclone, according to Trade Commissioner Kilcoin.—*The Planter and Sugar Manufacturer*, July, 1926.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Producer gas as motor-car fuel.

French automobile engineers have recently applied the suction gas-producer to furnish the explosive agent for motor-car engines. The reason underlying their experiments is to check the increasing importation of petrol from foreign countries. "Why pay 100 francs to the American Oil King, instead of 20 francs to French Charcoal-burners?" is their slogan.

A Ford van, fitted with a gas-producer weighing 353 lb. underwent an official test under the auspices of the Automobile Club of France. The total weight of the van, loaded with 900 bricks, in addition to the driver and two passengers, was 2.1 tons. The timetable was as follows:—

Hrs.	*Mins.*	
9	7 a.m.	Fire lighted.
9	8	Engine started on petrol.
9	12	Van moved off
9	15	Switched over to charcoal gas.
11	20	Five minutes' halt to recharge with charcoal.
12	25 p.m.	Stopped for luncheon.
2	11	Left for return journey on petrol.
2	15	Switched over to charcoal gas.
3	45	Five minutes' halt to recharge.
5	15	Arrived at Paris.

The total distance covered was 100 miles. The actual running time was 6 hours 7 minutes, or an average of 16½ miles per hour. Highest speed 21 miles per hour. Consumption of petrol 3 pints. Consumption of charcoal 87½ lb. Ordinary wood-charcoal was used in the producer. Wood-charcoal, however, possesses the following drawbacks; (*a*) it takes up moisture readily. and therefore should not be exposed to rain; (*b*) it crumbles easily and fouls the gas with dust; (*c*) it is bulky for its weight. These disadvantages have been overcome by employing spherical briquettes made from ground charcoal. These briquettes, called "Carbonite", are now manufactured near Bayonne, S. France, close to the great pine forests of the Landes.

Last year an open competition held by the Automobile Clubs of France and Belgium, included a Panhard-Levassor lorry, fitted with a gas producer using Carbonite only. The lorry weighed over 8 tons, developed 20 horse power, and moved over the whole course of 1,380 miles at an average speed of 18 miles per hour. The consumption of fuel was 1.3 lb. per mile. The vehicle travelled the entire distance without a single mechanical stop, although the roads were in bad condition. At the end of the journey, it was found that no chinkering had occurred.

A timber merchant in Boulogne makes his own charcoal fuel from wood-waste from his saw-mill. His tractor hauls 20-ton loads daily.

Carbonizing briquettes may be made, not only from wood-waste, but also from coal, coke, lignite-coke and peat-coke. It appears likely that such cheap and safe fuel for internal combustion engines may gradually replace petrol in commercial motor vehicles at least, thus conferring an inestimbale boon on those countries where wood is abundant, and where liquid fuel has to be imported.—*The Spectator*, 29th May, 1926.

The Chemistry of Rosin.

The exact composition of rosin is still unknown, although its examination dates back to 1826, when Baupe first showed that rosin contains crystallizable acids. Different investigators have isolated various acids from rosin, and have given names to them, such as abietic, pinic, sylvic and sapinic acids. Trammsdorf in 1835 showed that these acids possess the common empirical formula, $C_{20}H_{30}O_2$, but later workers have expressed the view that acids only arise during crystallization from alcohol, being produced by oxidation of parent anhydrides. Others again have adhered to the acid view, for example, Stock, who, in 1921, concluded that rosin consists of three free isomeric acids, namely—, a—b—and g—abietic acids. It seems difficult to decide therefore whether rosin consists of free acids, or whether these are not formed from their anyhdrides during the processes employed in their laboratory isolation.

Recently Shaw and Sebrell of the Goodyear Tyre Company at Akron, Ohio, have re-examined the question (*Ind. Eng. Chem.*, June, 1926, p. 612). They prepared samples of abietic acid from rosin by five different methods. They found that their preparations were isomeric compounds, possessing the same formula but different physical properties. They established the fact that abietic acid rapidly undergoes oxidation in air, yielding a mono-oxy derivative, which readily evolves water and leaves the mono-oxy abietic anhydride on heating. They therefore conclude that rosin is composed of free acids and not of acid anhydrides.

Franco-German Potash Agreement.

The French and German Governments have recently signed an agreement at Lugana, whereby the German potash market is reserved for the Deutsches Kalisyndikaat, and the French and French - Colonial market for the Société Commerciale des Potasses d'Alsace. These two syndicates have decided to establish a common fund for propaganda. For foreign supplies, division has been made as follows (excluding U.S.A.); 70 per cent. for German potash and 30 per cent. for Alsatian potash, up to a total annual sale of 840,000 tons. Above this figure, sales will be equally divided. At present, the total annual sale is 650,000 tons.—*Indus. Engin. Chem.* News Edition, 20th June, 1926.

COLLEGE NEWS.

Miss M. Beatrice Thomas, Lecturer in Chemistry, Girton College, Cambridge, visited the College on the 11th September.

Dr. E. A. Seagar, Professor of Tropical Hygiene, delivered an address on "The Economic Aspect of Tropical Agriculture," to the Agricultural Society of Trinidad and Tobago, on the 9th September.

Mr. L. C. C. Liebenberg, post graduate student for the Session 1925-26, left for Barbados on the 3rd September, to take his appointment as Assistant Geneticist on the Staff of the local Department of Agriculture.

Among the Post Graduate Students expected to arrive for the coming session are the following: 14 nominated by the Colonial Office; 10 by the Empire Cotton Growing Corporation, of whom 2 are from South Africa; 2 from the Gold Coast; 2 from India; and 1 from Ceylon.

In succession to Mr. P. E. Turner, who has been seconded for work on the Froghopper Committee, the Governing Body have selected Mr. Herbert Harry Croucher, B.Sc. (Lond.), as Lecturer in Chemistry. Prior to his appointment, Mr. Croucher was Demonstrator in Agricultural Chemistry at the University of Reading.

OBITUARY.

The sympathy of the entire staff goes out to Mr. C. Y. Shephard, Professor of Economics and Editor of this Journal, on the loss of his wife, whose death took place in Barbados on the 11th September.

H. M. LEAKE.

BOOK REVIEW.

CITRUS DISEASES AND THEIR CONTROL—By H. S. Fawcett and H. A. Lee. Mc Graw-Hill Book Company, Inc., New York and London.

As implied by the title the above volume deals with diseases within the one genus. In spite of this, however, the volume is in many ways comparable with Butler's "Fungi and Disease in Plants" and Nowell's "Diseases of Crop plants in the Lesser Antilles." By their detailed description of the macroscopic and microscopic characters of the various diseases the authors of the three volumes have aimed at, and admirably succeeded in giving valuable aid to the practical man in the identification and treatment of disease in his crop, and at the same time given scientific investigators sufficient detailed information concerning the casual organisms to enable them to make immediate use of the results accomplished and to suggest new lines of investigation. The three volumes have other points in common including the general "lay out" and the fact that they embody very largely the results of many years of diligent research work carried out by the authors themselves. The senior author has carried on his work in the Western hemisphere whilst the junior author's activities were mainly in the Eastern hemisphere. Between them, therefore, they have vast experience of the citrus growing countries of the world.

The volume is divided into four parts. Part I is given to general considerations which include historical information concerning investigations of citrus diseases, species and varieties of citrus, geographical distribution, and cultural operations operations in relation to disease. The second part deals with root and trunk diseases; the third with the diseases of branches, twigs and leaves; and the fourth with diseases of the fruit.

In addition to the contents already mentioned the volume contains an extensive bibliography and is well indexed. Furthermore, the authors have realised the full value of illustrations which include coloured plates, photographs of diseased portions of plants and fruit as well as microscopic drawings. These illustrations are all extremely good and in many cases are very beautiful. The large number and excellent quality of these illustrations enhances the value of the work very considerably.

There is such a mass of information in this volume that it is difficult to do it justice in this short review. It is a book that will prove invaluable to those interested in the citrus industry whether the reader be fruit foreman, estate manager, or plant pathologist. To those who teach economic mycology the volume will be a source of joy and relief, and they will wish for similar volumes on the other major crops like Sugar-Cane, and Cotton.

Few improvements only can be suggested, the most important being an extension or exclusion of the section dealing with the nature and classification of fungi. It is so scanty that it can prove of no benefit to those possessing no previous knowledge of fungi and to those who know something about them it is but boring repetition of what is now ancient history.

The information concerning citrus diseases in Egypt is not only more scanty than it need be, but it is also felt that it is faulty. For instance the "Wither tip" disease is known to occur in Egypt and it is doubtful whether the new disease described as "Chocolate Spot" is not primarily due to the "Wither tip" organism. In any case it must be considered strange that the fungi Alternaria, Cladosporium and Penicillium should produce a disease in Egypt which is different from the effects recorded for these organisms on citrus in any other part of the world including Egypt. The disease caused by *Alternaria citri* occurs in Egypt. As stated on page 465 of this volume "The Alternaria and Colletotrichum spots are not easily separated without cultural tests. Frequently both fungi are present in the same spot." In this matter, however, the informant (Tewfik Fahmy) is responsible and not the authors themselves.

H. R. BRITON-JONES.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—There has been no appreciable change in prices since our last report. The general situation has undergone no modification. The Continental beet crop is expected to be a short one. Cubes are selling at 33*s.* 9*d.*, Best Granulated at 30*s.*, West Indian Crystallized at 26*s.* 3*d.*, and Muscavado at 22*s.* 6*d.* each per cwt., duty paid. The continuation of the coal strike has been largely responsible for a disappointing demand in the United Kingdom.

COTTON.—The publication of the Bureau's report indicating the prospects of a reduced yield consequent upon insect damage and excessive rain resulted in a fairly sharp advance in prices. There is no suggestion, however, of an actual shortage of cotton. Mid-American, which touched 9.35*d.* per lb. on 17th August, reached 10.16*d.* on 26th August.

CACAO.—There is some scarcity of Accras spot which has resulted in a rise from 50*s.* to 57*s.* 6*d.* per cwt., but easier prices are expected with the arrival of new shipments. Ceylon Plantation and Trinidad Middling Red show slight weakening in price and are now fetching 86*s.* 3*d.* and 75*s.* per cwt., respectively. Grenada Fine advanced to 67*s.* 6*d.* The demand for chocolate is reported to be good.

COFFEE.—It is anticipated that the new Brazilian crop will be above the average and of good quality. On the whole the market has remained firm with some minor fluctuations. Some Blue Mountain Coffee has realised 210*s.*, Costa Rica Middling is steady at 160*s.*, Kenya Good Middling advanced to 115*s.*, after a slight decline, while Brazil Santos after a temporary rise again sold at 95*s.* each per cwt.

TEA.—Some slight advances have been recorded in prices for tea and the market remains firm. Stocks are normal, but imports have been below the average, while exports show increases. Averages on 25th August included 18.83*d.* for Ceylon; 17.82*d.* for India; and Java 14.83*d.* each per lb.

RUBBER.—The heavy stocks of tyres in the hands of Amercian dealers has rapidly been depleted since the end of June and altered the situation of the market considerably. Manufacturers are reported to be behind in deliveries. First Crêpe sells at 1*s.* 7¼*d.* to 1*s.* 7⅛*d.* and Ribbed Smoked Sheet at 1*s.* 7½*d.* each per lb. The London stock on 21st August, amounted to 29,678 tons compared with 5,396 tons a year ago and 9,113 tons on 20th February.

COPRA.—The downward tendency in prices has continued but the demand is a little more brisk. Prices on 25th August had reached £29 12*s.* 6*d.* for *F. A. Q.* Ceylon to London, £28 7*s.* 6*d.* for Sun-dried Straits to Rotterdam, and £27 10*s.* for Straits to Marseilles.

GROUD-NUTS—There are no quotations for Nigerian nuts. The new Indian crop sells at £20 *c.i.f.* for early December direct shipment. Chinese sells at £20 10*s.*

FERTILIZERS.—Sulphate of Ammonia has slumped in price from 13*s.* to 11*s.* 6*d.* per cwt. Nitrate of Soda remains unchanged at 12*s.* 9*d.*, while Sulphate of Potash has declined by 3*d.* to 11*s.* per cwt.

PALM KERNELS.—The weakening in price which began at the end of the second week in June continued until the third week in August, when a recovery of 7*s.* 6*d.* per ton to £20 7*s.* 6*d.* was recorded.

PALM AND PALM KERNEL OILS.—Prices for both are low although Palm Oil is somewhat firmer, but the demand is not great. Palm Kernel Oils sells at £42 and Palm Oil at £37 10*s.*

ECUADOR.

ACCORDING to the reports published by the *Camara de Comercio y Agricultura de Guayaquil*, the arrivals of cocoa to the port of Guayaquil from 1st January to 31st May, 1926, show a decrease of over 31 per cent. as compared with those of the same period of 1925. This decrease represents $1,850,000, and it is due to the exceptionally wet year and the consequent increase of fungi diseases.

In the Central and Eastern zones of the Arriba district, and in the Balao district, the decrease is mainly due to the witchbroom disease, and to a less extent to the Monilia.

In the Vinces-Quevedo Zone of the Arriba district, although the crop was very good, about 70 per cent. was lost on account of the Monilia which attacks the pods in all stages of development and increased considerably during April and May.

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